



## Pathological detection of nutritional muscular dystrophy in dromedary camel calves in Palestine

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### Abstract

Nutritional muscular dystrophy (NMD) is a nutritional condition associated with selenium and/or vitamin E deficiency affecting several animal species. Selenium and vitamin E function together as antioxidants that protect cell membranes from oxidative damage. The current investigation was conducted in a herd of fifty eight dromedary camels with an outbreak of NMD for the first time in Palestine with a mortality rate of 8.6%. Five calves died after several hours to a few days of the onset of clinical signs such as recumbency, stiffness, and muscle weakness. Necropsy was performed on three dead calves that were evaluated grossly and tissues were collected for histopathology. After the routine tissue processing, samples were stained with H&E and examined under the light microscope. The examined calves exhibited clinical symptoms as well as microscopic and gross lesions compatible with cardiac muscle necrosis and degeneration. The use of Vitamin E and Selenium therapy reduced clinical symptoms and terminated the mortality. The findings show that NMD occurs in Palestine in calves of camels. This study describes clinical and pathological findings related to the death of calves. Further research is needed to determine the prevalence and impact of this disease on the health of camel herds in Palestine.

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### Introduction

Dromedary camels are important animal species, which are adapted to hot, and arid environments. They play a significant role in supporting of livelihood and survival of Bedouins in Palestine as well as a source of income (1). Information about the status of dromedary camels in Palestine is so scarce. Based on the Palestinian Central Bureau of Statistics (PCBS); there are about 2058 camel heads in Palestine used mainly for meat and milk production and transportation (2). Camels were relatively thought to be resistant to most of the diseases commonly affecting livestock (3). Nevertheless, camels are susceptible to several diseases or can act as a carrier and reservoirs for the transmission of different livestock and human pathogens (4-9). In Palestine, camel herders are commonly living in

remote areas where veterinary services are not easily available. The most commonly reported camel infectious diseases in Palestine were surra, camelpox, scabies, and mastitis (1,10). To the best of our knowledge, no reports targeted non-infectious diseases in camels in Palestine. Nutritional muscular dystrophy (NMD), also known as white muscle disease, is a non-infectious metabolic disease manifested as an acute degenerative disease of cardiac and skeletal muscle; dietary deficiency of selenium and/or vitamin E is the main cause of NMD (11-15). NMD represents a common problem in young rapidly growing farm animal species, especially calves, lambs, kids, and foals (16). Only a few studies have reported the severe or fatal impact of NMD on both adult and young camels in dromedaries and Bactrian camels (17-19).

To the best of our knowledge, there is no report on NMD in dromedaries in Palestine. Therefore, this study aims to report an outbreak of NMD in a dromedary herd in Palestine with special reference to clinical and pathological characteristics.

## Materials and methods

### Ethical Approve

This study was conducted at An-Najah National University. Samples were collected from dead animals only after the owner's approval. The protocol of animal examination on the animals were approved by the Palestinian Animal Welfare Committee (code: 12B 2021).

### Animals and study area

The outbreak occurred in March 2021 in a dromedary farm consisting of 12 calves, 17 adult male and 29 adult female camels located in the Negeb desert (30°50'N 34°45'E) in southern Palestine. Camels were kept in an open area and the diet consisted of corn, barley, and hay with free access to water. The study was conducted on three calves aged 2 to 3.5 months. The suspected calves show signs of recumbency, stiffness, and muscle weakness. Some calves exhibited respiratory signs. Five calves died after several hours to a few days of the onset of clinical signs.

### Gross and histopathology

Three dead calves were submitted for necropsy as a part of the diagnostic service of the Department of Veterinary Medicine at An-Najah National University under the usual veterinary service work in Palestine. Postmortem findings were recorded. Skeletal including; gluteus medius muscle, intercostal muscles, and diaphragm muscle as well as cardiac muscle samples were fixed in 10% neutral-buffered formalin and sent to the central diagnostic laboratory of the Department of Veterinary Medicine at An-Najah National University – Nablus for further analysis. The collected samples were embedded in paraffin wax and stained with hematoxylin and eosin for histopathological examination following standard procedures (20).

### Results

The incidence mortality rate in this outbreak was 8.6 % (n=58). Clinical manifestations observed in calves (n=12) included recumbency, stiffness, and muscle weakness (Table 1). Some calves showed severe panting with increased abdominal respiration. The calves (n=5) died after several hours to a few days of the onset of clinical signs. No clinical findings were observed in adult camels. On necropsy examination, the observed gross lesions consisted of white streaks in cardiac muscle fibers (Figure 1). There was moderate hydrothorax, hydroperitoneum, and hydropericardium. No other lesions were observed in

skeletal muscle. Microscopic examination showed cardiac muscle cell degeneration and necrosis characterized by fragmentation of muscle fibers, loss of cross striation, hypereosinophilia with pyknosis, karyorrhexis, and loss of nuclei. Scattered basophilic granules were also noted which represent areas of calcification (Figure 2). A therapeutic regime for selenium/vitamin E in suspected seven young calves from the herd involved in the study, which consisted of 0.06 mg of sodium selenite per kg subcutaneously, 640 mg of D-alpha-Tocopherol per calf. A progressive clinical improvement was observed in the young calves.

Table 1: Frequency of observed clinical signs calves (n=12)

Clinical signs	Frequency
Recumbency	5
Weakness	12
Stiffness and muscle	7
Panting with abdominal respiration	12

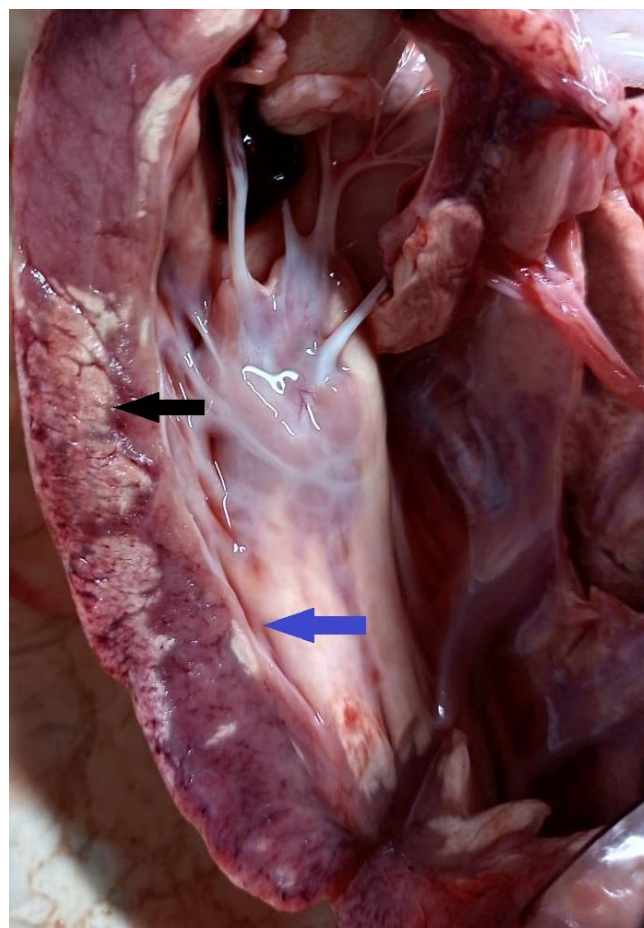


Figure 1: Heart of a camel calf with NMD showing prominent white areas of necrosis with mineralization of subepicardial (black arrow) and subendocardial (blue arrow) in the myocardium.

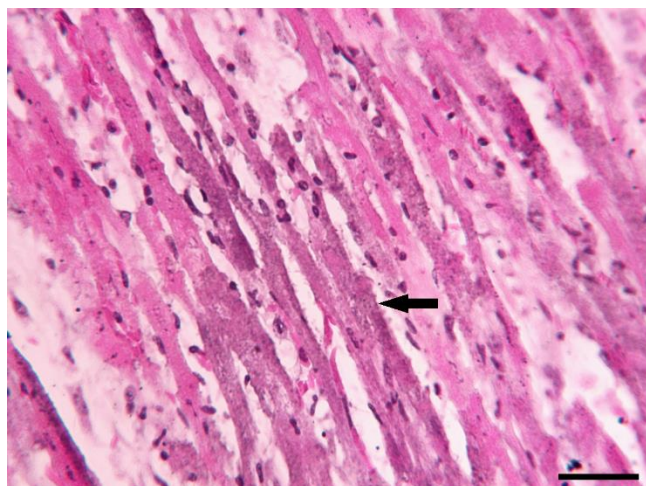


Figure 2: Section of myocardium from a camel calf with NMD showing acute myocardial necrosis with mineralization (black arrow). (H & E, magnification 400X, Scale Bar = 50  $\mu$ m).

## Discussion

Nutritional muscular dystrophy has long been suspected to occur in camels. However, few previous studies have described the disease in camels, while the disease is not reported in camel herds in Palestine (17,21). In this study, an outbreak of NMD has been reported for the first time in a dromedary herd in Palestine. The diagnosis of NMD in this herd was confirmed based on clinical signs, and gross and histopathological findings. The reported mortality rate in this herd was close compared to other studies in camels and other livestock. For instance Corbera *et al.*, 2003 reported 13.2 % (n=167) mortality in one herd in Spain (21). Similarly, in the United Arab Emirates, 10% (n=80) of cases were reported in one flock. In other species, NMD in lamb with a low vitamin E level was reported as 9.2 % (n=82) in Iraq (22). Clinically two forms of NMD were identified; the cardiac and skeletal forms. NMD in immature animals more commonly involves the cardiac muscle, while the skeletal muscle is more common in adults. The sudden death in calves in this study might be due to cardiac muscle necrosis. In the current study, calves exhibited different clinical findings than adults, indicating the cardiac form. Similar findings were also mentioned in other species (23,24). The clinical signs in this study were similar to NMD described in camels and other livestock (18-32).

One limitation of the current study is that does not provide data on the evaluation of vitamin E or selenium in the blood of the affected herd due to the unavailability of the diagnostic test (25). However, the observed gross, as well as histological findings in the affected calves in our study, were compatible with previous studies in camels (17).

Selenium is of essential mineral for both humans and livestock with antioxidant, anticancer, anti-arthropathy, and antiviral effects (33-37). There is little data concerning the selenium requirements in camels (32). NMD generally affects young growing animals more often than adults (38). Al-Awadi and Srikumar (39) reported lower values of selenium in camel milk. In addition, Chen *et al.* (40) reported that selenium in camel milk appeared significantly lower than in cow milk. This brings into question the possibility of NMD in young camels could be attributed to selenium deficiency in dam's milk. On the other hand, camels appear very sensitive to selenium supplementation. A previous study showed that the maternal transfer of selenium in camels was very efficient in calves camels after supplementation in dams compared with the non-supplemented group (41). Therefore, diets provided to pregnant and lactating camels and young calves should be properly balanced to assure adequate intake. Camels in Palestine feed mainly on poor-quality perennial natural vegetation of low nutritive value. In addition, camels are supplemented with dried hey, barely, and other remaining of crop harvests (1). Therefore, cases of NMD could also be linked with low nutritional quality and poor diet, which may further increase the incidence of nutritional myodegeneration and other diseases. Treatment with vitamin E and selenium can relieve the clinical signs and decrease the losses. Further studies are needed to assess the impact of nutritional deficiencies on the health of camel herds in Palestine.

## Conclusion

Nutritional muscular dystrophy (NMD) is reported to cause clinical disorders and mortalities for the first time in a herd of dromedary camels in Palestine. The clinical signs and gross and microscopic lesions are consistence with cardiac and skeletal muscle lesions. Further studies are needed to estimate the incidence of this disease, which threatens the camel herd's health in Palestine.

## Conflict of interest

The authors declare no conflicts of interest.

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وخمسون من الإبل العربي مع نفوق خمسة عجول من الإبل لأول مرة في فلسطين بمعدل نفوق بلغ ٨,٦ بالمئة. تم إجراء التشريح المرضي على ثلاثة عجول نافقة حيث تم تسجيل الأفات المرضية العيانية وتم جمع عينات من أعضاء هذه الحيوانات النافقة من أجل إجراء الفحص النسيجي. بعد معالجة الأنسجة، تم صبغ العينات بصيغة الهيماتوكسيلين واليوزين ومن ثم فحصها تحت المجهر الضوئي. أظهرت العجول التي تم فحصها أعراضاً سريرية مثل الرقود وتصلب وضعف في العضلات بالإضافة إلى آفات عيانية ومجهريّة متوافقة مع تنخر عضلة القلب وتتكسها. أدى استخدام العلاج بفيتامين هـ والسيلينيوم إلى تقليل الأعراض السريرية في بعض العجول المصابة في القطيع وتوقف الوفيات. إن نتائج هذه الدراسة هي دليل على وجود مرض الحثل العضلي التغذوي في عجول الإبل العربي في فلسطين. تصف هذه الدراسة النتائج السريرية والمرضية التي أدت إلى نفوق هذه الحيوانات. هناك حاجة إلى إجراء المزيد من البحث لتحديد مدى انتشار وتأثير هذا المرض على صحة قطعان الإبل العربي في فلسطين.

## التقصي السريري والمرضي لتفشي الحثل العضلي التغذوي في عجول الإبل العربية في فلسطين

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### الخلاصة

الحثل العضلي التغذوي هو حالة غذائية مرتبطة بنقص السيلينيوم و / أو نقص فيتامين هـ الذي يؤثر على العديد من الأنواع الحيوانية. يعمل السيلينيوم وفيتامين هـ معاً كمضادات للأكسدة تحمي أغشية الخلايا من التلف التأكسدي. تم إجراء الدراسة الحالية في قطيع مكون من ثمانية